Coal ash and risk: four social interpretations of a pollution landscape

Authors: Vanesa Castán Broto, Paul Tabbush, Kate Burningham, Lucia Elghali, David Edwards

Correspondence address:
Vanesa Castán Broto
Environmental and Human Sciences Division
Forest Research,
Alice Holt Lodge,
Farnham,
SURREY - GU10 4LH.
UK

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ABSTRACT

The purpose of this paper is to examine how cultural and natural components of landscapes interact in the context of environmental change. The paper looks at an example of a "pollution landscape" through the lens of four distinct perspectives on the relationship between landscapes and society derived from the literature. The aim is both to develop a holistic understanding of the interaction of landscape and society in the case study and to explore the insights and limitations of each perspective.

The case-study explored in this paper is the case of coal ash pollution in the city of Tuzla in Bosnia and Herzegovina. Environmental changes due to coal ash pollution in Tuzla have compromised the capacity of the landscape to provide societal needs and generated new meanings associated with the landscape. The case-study shows that landscape influences local perceptions of environmental risks and as a result, local inhabitants develop risk management strategies dwelling in a pollution landscape. The paper concludes that understanding the relationship between landscapes and societies may be understood best as an interactive complex, examining the actions performed in and by landscapes.

KEYWORDS

Coal ash pollution, social constructionism, pollution landscape, Bosnia and Herzegovina

INTRODUCTION

The city of Tuzla, the industrial centre of Northeast Bosnia, has 170,000 inhabitants dispersed along the Majevica Mountain. Its name derives from the Turkish word *Tuz*, salt: Turkish records of industrial exploitation of Tuzla salt can be traced back to the sixteenth century (Clancy and van Enkelen, 2005). Modernisation started during the Austro-Hungarian rule in the seventeenth century, when industrial methods for coal and salt mining were introduced. Later, during the years of the Former Yugoslavia,

industrialisation reached its peak, with the development of several chemical industries and above all, the Tuzla thermo-electric power plant (henceforth TEP). Today, Tuzla's industries find themselves struggling to compete in a global market, while environmental degradation is causing significant local, national and international concerns. TEP has been identified as one of the main point sources of pollution in the area of Tuzla (Brkić and Barčić, undated). From every hill in the West of Tuzla, TEP dominates both land and sky: the disposal of coal ash in the surrounding areas and the sulphur emissions permeate the lives of the inhabitants of Tuzla. Even the climate of the valley seems to be modified by the steam water clouds emitted by the plant's coolers.

Ash is one of the main by-products from TEP. Ash and slag are transported hydraulically into settling ponds enclosed by a dyke. The water is either reused by circulation or returned to the river Jala. The disposal of waste is projected to continue for at least the next 25 years, and TEP has plans to enlarge the current disposal area. Local communities have confronted TEP with its environmental impacts (Brkić and Barčić, undated). One of the steps taken by TEP has been to join an EU funded consortium, RECOAL, which is developing remediation solutions for the disposal sites.

The European Landscape Convention[1] defines landscape as "*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*". Rather than focusing on either cultural or natural components of landscape, the Landscape Convention looks at how they interconnect. The Convention also suggests that people living a landscape should be given an active role in decision-making.

But what occurs when landscapes undergo environmental pollution? The relationship between landscapes and societies must endure constant environmental modification, destruction and creation: the result is that alongside the facets that humans admire, landscapes also display "*the threatening, the awesome and the disgusting*" (Cosgrove, 1998; p xxix). Environmental pollution becomes, therefore, just one of the characteristics of those landscapes.

However, in some cases, environmental pollution occurs in such a way that the consequences of change become the dominant feature of the landscape. As explained above, industrial diffuse pollution is the predominant characteristic of the landscape in Tuzla. The landscape contains new elements, some of which may be prejudicial for human activities in that landscape. Pollution has transformed both the

material and symbolic features of this landscape, and in so doing a new relationship between landscapes and society has emerged.

This paper is concerned with the material and symbolic dimensions of the pollution landscape of Tuzla. Furthermore, landscapes need to be understood for what they "do", not only for what they "are" [material landscapes] or what they "mean" [symbolic landscapes] (Mitchell, 2002; p.1). Mitchell suggests that landscapes may even be agents of power that are (or represent themselves as) independent from society (Mitchell, 2002; p.2). The paper offers a review of some different standpoints derived from the literature that enable us to understand landscapes. The results are presented in four sections, following four distinct perspectives: landscape as provider of social functions; coal ash disposal and landscape meanings; landscape agency and the perception of the environmental risk; and dwelling in a pollution landscape.

FOUR THEORIES ON THE RELATIONSHIP BETWEEN LANDSCAPE AND SOCIETY

A common view on landscapes is to understand them as providers of social functions. For instance, landscapes take part in multiple processes for the preservation of ecosystems such as sediment and nutrient trapping, pollutant degradation, or flood control (eg Leibowitz *et al*, 2000). Often, the assumption underlying this view is that landscapes can be modified by humans in order to obtain human commodities (Darvill, 1999;p.105; Relph, 1985 in Thomas, 1993;p.27). However, as Rackham (1990) puts it, landscapes are not mere "artefacts" that can be modified according to human design; rather they are living systems in constant evolution with a significant symbolic component (Rackham, 1990).

What are the meanings attached to landscapes? Some authors explain that place meanings range from utilitarian values to sense of belonging, spirituality or aesthetics (Cheng, *et al*., 2003). But meanings are not inherent to a place. Meanings are conferred to landscapes by human experience and social action (Tuan, 1977 in Stedman, 2003; Darvill, 1999;p.109; Greider and Garkovich, 1994). Landscapes are socially constructed with meanings attached by social actors (Greider and Garkovich, 1994).

Landscapes are both material and symbolic (Mercer, 2002). However, landscapes also have their own agency. The natural components of landscapes do not always react to human action in a predictable way. Sometimes they are stable enough to overcome "*fashions in land use*" (Rackham, 1990); in other cases they may respond to human action in unexpected ways.

Moreover, the physical features of a place will also influence the meanings attached to a particular setting, contributing to a sense of place (Stedman, 2003). For instance, individual interactions with a place are influenced by its physical features, together with other social and cultural factors (Cheng, *et al*., 2003). Space and observer are mutually constituted (Massey, 1994).

Some scholars have proposed to extend the concept of human agency to non-humans (Murdoch, 2001). Landscapes have the capacity to produce physical and symbolic outcomes from a range of possible alternatives. Thus, landscapes may also have their own agency. This does not imply a reification of nature, but rather, it recognises the capacity of living systems to cause change and generate random responses. This view challenges more determinist perspectives on landscapes which may fail to acknowledge the uncertainty that characterises landscape processes.

Another way to understand the dual relationship between landscapes and societies is to consider landscapes as places of dwelling (Thomas, 1993; Ingold, 2000). This implies a lack of distance between people and things; in places of dwelling humans engage with the landscape through daily practices rather than by detached visual contemplation (Thomas, 1993; Macnaghten and Urry, 1998; 201). Thus, landscapes originate in a compendium of human activities and interactions. They are activity spaces in constant evolution (Massey, 1994; 155).

Methodology

While studying the Tuzla case the different perspectives seemed to be useful to make sense of such a pollution landscape. In order to do so, we compiled the data gathered so far for the project RECOAL. This included e-mails, project reports and observations made during project meetings and 17 interviews with representatives of several local institutions. The results from the interviews were classified and coded using qualitative data software[2].

The data was grouped into four categories, according to the four different understandings of the relationship between societies and landscapes observed in the literature, as described above. First, landscapes may be understood as providers of social functions. This view is commonly held in the literature of landscape planning. Second, landscapes can be understood as socially constructed places of meaning, building on the tradition of social constructivism that has received considerable attention within environmental sociology. Third, landscapes and societies may be engaged in a mutual two-fold relationship in which landscapes are capable of modifying human experiences of the environment. And finally, societies and landscapes may be understood as an interactive complex constituting the context of human action, a place of dwelling. Figure 1 presents a representation of these views.

INSERT FIGURE 1 HERE

The aim is to establish a framework against which different positions on the relationship between landscapes and societies can be compared. However, the framework may not be sufficient to assess every perspective in isolation. Instead, it is a useful analytical tool to explain how the different perspectives interact and complement each other.

Landscape as provider of social functions

The first perspective to be applied sees landscapes as providers of social functions. Landscapes provide several functions such as maintenance of energy and material balances, supply and protection of water resources, support for economic activities, the preservation of habitats and biodiversity, visual enjoyment and recreation.

Pollution compromises the maintenance of material and energy balances. For instance, in Tuzla, the coal ashes are deposed in wet lagoons. RECOAL scientists have identified two main issues of concern related with coal ash disposal:

- The dispersion of coal ash particles by the wind, polluting air, water and soil; and
- The leaching of Potential Toxic Elements (PTEs) from the disposed ash.

Pollution results in the introduction of extraneous substances potentially harmful for humans and ecosystems. For instance, PTEs such as arsenic (As), boron (B), nickel (Ni), cadmium (Cd) and

chromium (Cr) have been found in the layer of soil capping one of the disposal sites. Because these elements occur naturally the issue is to determine whether or not the relative concentrations of these elements is anomalously high relative to "normal" background levels (Alloway and Ayres, 1993, 140). Hence, the existence of pollution will depend on what "normality" is or how it is defined. A way to establish normality is by comparing the concentration values with those obtained in other locations with similar geographical characteristics. Another option is to examine what are the minimum concentrations that would endanger determined human activities. For instance RECOAL scientists argue that in their samples the concentrations of PTEs mentioned above exceed the "tolerable thresholds for agricultural soils" (BTUC, 2005).

Coal ash pollution also compromises the protection of water resources: changes in the chemical and physical properties of the water may constrain their use. The importance of these changes depends on how the water is going to be used. For instance, RECOAL scientists explain that the concentrations of some PTEs, such as arsenic or boron, in the water samples have been found to exceed the thresholds for "drinking water standards" (BTUC, 2005). In addition, concentrations are also compared with the concentrations of these elements in other rivers. For instance, most water samples taken in the disposal sites have higher concentrations of arsenic or boron than those measured in the rivers Elbe and Rhein (*Ibid*). Changes in the chemical composition of soil and water are therefore analysed through a comparative approach, which requires a definition of normality. Environmental problems are aggravated by the proximity of the disposal sites to human settlements (Figure 2).

INSERT FIGURE 2 HERE

The Tuzla disposal sites have been recultivated after capping with a thin layer of soil (10-50 cm). Given that there are questions about its safety, it is surprising to find some local residents interested in the cultivation of those sites. An explanation arises by looking at the physical conditions of farming. The deposition of ashes in the valley has created flat areas in a mountainous geography that are relatively easy to cultivate. Moreover the application of ashes to the soil may improve its structure and its water holding capacity (Adriano and Weber, 2001), possibly increasing soil productivity in the short term immediately after application. It is possible that an initial rise in productivity may have influenced the intensity of agriculture on those sites. In this case the physical and chemical analyses offer two

complementary descriptions of reality. Cultivation of the disposal sites is possible, and due to the improvements of its physical characteristics, the soils are likely to provide an increase in the yields; however, the crops could take up some of the PTEs, possibly introducing them into the food chain.

Following the process of sedimentation, fine ash particles are disposed of in the top layers of the lagoon. During drought periods the wind transports and deposits dust around the region. A scientist who had worked in the area explained in an informal interview:

> "*These ashes would be dispersed all around; imagine the markets, when you go to buy a piece of fruit and you find that it has a dirty black layer of ashes…"*

The effects of the ashes go beyond the pollution of soil, air and water resources. The ashes influence all human activity, from the visual enjoyment of the landscape to the development of economic or cultural activities. The effects of the ashes are visible from different locations. The disposal sites disrupt the valley structures. Once the lagoons are drained the ashes constitute a "*black desert*" filling the space between the hills. In some disposal sites a soil cover has been applied to reduce the evolution of dust; this has provided the conditions for re-vegetation and therefore the visual impacts are less dramatic. Pollution does not only refer to the introduction of potentially harmful chemical elements; pollution is also about the interaction of all the elements of landscapes at different scales: it occurs when the landscape is transformed in an unfamiliar place.

Environmental change due to the coal ash has interacted with a multitude of additional environmental and social-economic factors, which make it very difficult to explain the problem in environmental terms only. The coal ash pollution is one source of pollution among many others including those from a nearby chemical plant and mining industries. The Bosnian war (1992-1995) also induced notable environmental change. Some impacts of the war on the Bosnian landscapes include the degradation of forest due to fuel needs in nearby cities, and outbreaks of bark beetle colonisation due to artillery and bomb damage (see Dudley, *et al*., 2002).

Understanding the landscape as the provider of human needs may enable us to point out routes of action to reduce or control the pollution: for instance by reducing the concentrations of PTEs from that landscape. However, this approach presents some problems. What pollution is can be defined

differently depending on the functions that the landscape may serve. For instance, higher concentrations PTEs may be less significant if we are going to use the water for irrigation than if we use it for drinking.

Studying pollution as a chemical phenomenon in the landscape requires a reduction of scale that may not be appropriate for the study of landscapes; yet it provides solutions to some of the practical problems arising. Even though reductionism is commonly associated with oversimplification (Gallagher and Appenzeller, 1999) it may be unavoidable whilst studying landscapes as providers of human needs. In a landscape, the complexity of natural phenomena adds to the inherent complexity of the social interactions which define it. Understanding the individual elements of a landscape will only give us a partial view of landscapes without reflecting the interactions between its elements. The next section examines how landscape meanings can also inform the study of pollution landscapes.

Coal ash disposal and landscape meanings

The second perspective applied in this study understands landscapes as constructed places of meaning; meaning is attached to landscapes through social action. The disruption of those meanings by pollution may cause (or resolve) social conflicts. Contradictions seem to arise not only between the different social actors, but also within the narratives of individuals; this is the result of the dynamic nature of landscape meanings which are renegotiated in every process of human interaction.

As the energy provider TEP comes into the houses of local people: it provides the heating for the city of Tuzla while it also pollutes the air. However, TEP's owner, Elektropiveda, is managed at the State level by the Federal Government. TEP provides local employment but its major economic benefits are from exporting electricity; a municipality worker says: "*Tuzla gets the pollution and Sarajevo gets the benefits*." This phrasing suggests that TEP is perceived as a symbol of an inaccessible central government. The enormous complex of buildings of TEP and its network of infrastructures (pipelines, disposal sites, water vapour clouds and so forth) seems to evoke the inaccessibility and obscurity that the citizens associate with bureaucratic structures. Furthermore, the former regime seems to resonate in the industrial landscape. A local NGO worker suggested that the TEP symbolised the "*the strategy of former Yugoslavia*", that is, "*development regardless of the consequences*".

INSERT FIGURE 3 HERE

But this view of TEP as a symbol of dominance is only a partial view. Closer inspection reveals different encounters with this particular pollution landscape. TEP is simultaneously a provider of wealth and a poisonous threat. Its overwhelming presence in the Tuzla suburbs causes ambivalent feelings, as has been observed in other cases of chronic pollution (eg Wynne, 1996). Alongside the industrial constructions, the landscape presents elements belonging to the people living on it: wherever the soil in the disposal sites allows cultivation, farming practices are taking place; not only food crops, but also trees and hedges show man's willingness to make a better landscape around the villages; where the disposal sites lack soil, people develop other activities such as keeping sheep among the willows or walking the dog; houses, isolated or in groups, arise in the hills, some of them extremely close to the disposal sites; the paths are well maintained, and trees are planted close to the pipelines. The pollution landscape has not been abandoned but appropriated.

The literature on symbolic meanings of landscapes commonly argues that how landscapes are socially constructed determines how they are used to reinforce dominant discourses of power and knowledge. Harner (2001) understands landscapes as reflections of the current hegemonic (or dominant) discourse in an area. Following this premise, he concludes that when the hegemonic discourse is absent, identity can not be materialised in landscapes, and, as a consequence, landscapes become contested (Harner, 2001).

In contrast, landscapes can be understood as social constructions that become negotiated in everyday life, rather than being spaces for confrontation. Although domination and contestation may occur as part of the negotiation process the outcome is the result of multiple struggles for power. For instance, Petrzelka (2004) describes the example of the "discovery" of the landform "*Loess Hills*" in western Iowa. The landform was first described by the scientific community, only to be adopted by the local residents as a new identity feature. The uniqueness of the new landform helped the local community to face new socio-economic challenges swapping from agriculture into landform tourism (Petrzelka, 2004). As in the Petrzelka story, local people in Tuzla have appropriated some of the elements of the landscape. The socially constructed landscape is negotiated through subtle everyday practices, from cultivating the disposal sites to awakening memories whilst contemplating the landscape.

Social meanings attached to a landscape may acquire negative connotations after a pollution event. For instance, talking about a contaminated community in Legler, New Jersey, Edelstein (2004) shows the desperation that may pervade an area coping with a disaster. Legler inhabitants found new things in their environment that made their landscape odd and unfamiliar. For instance they observed their fruits growing disproportionately or experienced strange smells coming out of the water (Edelstein, 2004; ch 3). Similar fears arise in the communities in Tuzla, whose locals may have seen how pollution pervades the elements of their common life. A local representative in one of these communities explains: "*Our fruit trees are destroyed. For example, our cherries are completely destroyed. There are no cherries*".

Edelstein observed that the Legler community adopted a vision of a malevolent environment responding to unbalanced human actions. This implied not only a shift of meanings attached to the landscape but also a redefinition of the people's identities and their views for the future (Edelstein, 2004;p.89). A local representative of communities close to the Tuzla disposal sites explained: "*there are people who grow the wheat there. This is what kills people over here*". Is the pollution landscape a killer, rather than a provider of subsistence food? The environment is represented as a negative force that influences their lives. Talking about TEP's contribution to environmental degradation a local NGO worker comments "…*the power plant is even friendly… like we have even seen flowers around it; they want it to look nice*". By saying this, the worker is implying that TEP wants to look nice [they even care about the visual appearance of their landscape] but *they are not nice* [behind the efforts on the visual appearance lies the spectre of pollution]. *In her view* "*local communities from this power plant do not get anything but polluted air…*" Local actors may feel threatened if, while the benefits of TEP are shared at the national level, the impacts of pollution are experienced locally. Moreover, local people imply that "suffering the pollution" establishes the grounds to demand compensation benefits. Compensation is a potential way of bridging the gap between national and local scales.

Different cultural backgrounds and understandings [and possibly interests] can produce different views on a particular landscape. Memories, grounded in local perceptions, are cultural representations through which landscapes are socially constructed (Lahiri and Singh, 1999). The pollution event is magnified by contrasting it with the landscapes that remain in the memories of local villagers. Residents recall their past landscapes with nostalgia, regretting how the relationship they had with their landscape has deteriorated. A local member said: "*we had a picnic ground in Bukinje [one of the towns*

close to the disposal sites] in 1960, and people used to celebrate the Labour Day, over here": the pollution landscape is not a place for celebration anymore.

This section summarised some of the possible meanings that can be attached to a pollution landscape. How meanings are attached depends on individual experiences and on how those meanings are communicated. Meanings become negotiated in every process of human interaction. The assessment of the importance of landscapes for human societies is incomplete without understanding its symbolic dimension. In addition, the study of these meanings may be helpful to identify possible routes of consensus about the significance of environmental change in that landscape. The symbolic dimension of landscape may explain what is acceptable for the society that lives in that landscape, and therefore may contribute to redefine adequate strategies of landscape management. However, understanding landscapes as places of meaning does not reflect that landscapes, as living systems, are unpredictable and they also influence human experience. The next section examines how this influence may occur.

Landscape agency and the perception of environmental risk

The third perspective considers that the relationship between landscapes and societies is two-fold, and landscapes are credited with their own agency. Because landscapes have their own agency in responding to environmental change, society faces unexpected responses from their landscapes. While scientists may contend the details of local interpretations, people surrounded by the pollution may develop an understanding of the pollution that will modify their actions within the given landscape.

There are many examples of how physical changes caused by environmental pollution have modified local experiences of the landscape. Local villagers talk about the pollution effects on animals and plants with vivid descriptions of the impacts of the pollution on their surroundings. Following the creation of the disposal sites local communities have lost common forest areas and see game and fishing disappearing. Water pollution has resulted in the closure of several wells. Dust encroaches upon the cultivation of their home gardens.

INSERT FIGURE 4 HERE

The soil cover on the sites was established to stop the dust evolution that caused public concerns at the end of the 1980s. However, once the ashes were covered with soil, farming started on the sites without any institutional control. Local people explain that the scarcity of food suffered during the war (1992-1995) fostered the cultivation of the sites. After the war, cultivation continued, but opposition to cultivation surfaced within the local communities. A local representative in Bukinje explained that the cultivation of the sites for food and fodder was related to ill health within the local communities: "*…there are people who grow the wheat there* [on the sites], *clover, and other crops. This* [pollution through the food chain] *is what kills people over here....*"

The example above shows that the capacity of landscapes to modify human experiences is not limited to influencing physical observations on the environment, but rather, landscapes may also influence how individuals and groups construct new symbolic meanings of landscapes and society. Moreover, landscape features can interrelate with social conflicts and intervene in power relations. For instance, while talking about the lack of trust in TEP and municipal experts, a local inhabitant said that:

> *"…they keep on tricking us, that [the] situation is not alarming. There was "a yellow snow" on Thursday and again it is not alarming*."

In this quote, the interviewee demonstrates his lack of trust on the authorities in charge of environmental pollution. He says '*'they keep tricking us'* because he perceives official assurances on the state of the environment as deception attempts. In order to support his argument, the landscape is called as the witness of the pollution problem that people are suffering. Landscapes can not be reified to speak in words. Rather, landscapes "speak" with facts and signs. In this case the fact is the "*yellow snow*". A common event, the snow, is transformed into something abnormal and unexpected when changing its colour. The atypical phenomenon casts a doubt on the opinions of 'experts' and justifies a change of attitude towards them within the local communities.

The assemblage of everyday observations on the environment may lead to the development of new sources of expertise. For instance, local inhabitants living close to the Tuzla coal ash disposal sites said that they are aware of the health risks that surround them. They highlight that there is a disproportionate incidence of cancer and that few local people reach 60 years. Apart from the day to day observation of the local dynamics, local people have their own "experts": they support their own

opinions by referring to communications made to them by friends "*with a PhD*" or their local doctor. Expertise is not a monopoly of outsiders. Local people develop their own expertise. The signs provided by the landscape may constitute one of the sources of this expertise. Both "experts" and "lay" people develop different understandings depending on the social context in which they develop their actions. However, in order to develop those meanings they refer to phenomena observed within the landscape, such as changes in the ecosystems or in land uses. Because of the uncertainty attached to the whole process of environmental change, landscape responses are perceived as environmental risks. Thus, landscape agency may influence human perception of environmental risks.

The perception of the pollution risk is directly related to the experiences in the communities surrounding the coal ash disposal sites in Tuzla and it influences the meanings that people attach to a place. In Tuzla, the perception of those risks is affected by the observation of atypical phenomena on the landscape such as the "*yellow snow*". By influencing the perceptions of risk, landscapes affect the very social construction of those landscapes. For instance, in Tuzla, atypical phenomena transform an apparently familiar landscape into a "pollution landscape", potentially threatening the lives of those living in such a landscape. Thus, landscapes may modify the processes that humans use to attach meanings to landscapes.

This perspective shows that landscapes may influence human experience and, therefore, determine the ways in which meanings are attached to nature, reformulating, for instance, the social construction of landscapes. Understanding how these processes occur may reveal the different perceptions of the actors living in such a landscape. This process is, however, non static. The mutual influence of society and landscape seems to merge both together in an interactive complex. The next section attempts to understand this "interactive complex" as the result of the multiple actions that the different actors develop on the landscape where they dwell.

Dwelling in a pollution landscape

The fourth perspective understands landscapes and societies as elements impossible to tell apart in the context where humans develop their actions. In the past section, we have seen that landscapes have agency not only to physically influence the environmental changes in which they are involved, but also

to modify the ways in which society understands them. The perception of risks influences the activities of people dwelling in pollution landscapes. People develop strategies to cope with those risks.

One of the first steps in the development of these strategies is the formulation of an understanding of the risk problem within the local context. For instance, local people around Tuzla named "radiation" as the major problem associated with the coal ashes, contradicting current technical and expert assessments of the sites which draw attention to the high concentrations of PTEs. In accordance with risk literature, referring to radioactivity highlights the lack of control local people feel that they have over these risks (Davis, 2005). Because radiation is not perceived to be localisable or reducible to individual parts, the concept of radiation may resonate with the local understandings of pollution within the landscape as a whole. In any case, local concerns about radiation demand the investigation of this issue as a priority, in order to address the concerns of those who live in the pollution landscape.

Pollution is embedded in all aspects of everyday life. There are not one but several sources of pollution. Together with the thermo-electric plant there are, in the area, a chemical industry, solid waste disposal sites, 4 petrol stations, a concrete factory, a construction material warehouse and communal infrastructure in bad condition (sewerage, roads, water supply, waste disposal). The difficulties in establishing causal links between the industry and their risks opens the door for a range of individual explanations, tainted with scepticism (Beck, 1992; 31). The consequence is what Beck calls "*organised irresponsibility*": a range of human-created risks for which no one is accountable (Giddens, 1999).

People dwelling in a pollution landscape may have a holistic view of it, in which all the environmental and social elements seem to be interconnected. Under a holistic view of the landscape, one possible strategy to cope with pollution may be to continue "business as usual", as if the risk were non existent. There are several examples in the literature in which risks caused by chronic pollution may become integral accepted parts of everyday routine. For instance, people may just "*get used to it"* (Sapountzaki and Chalkias, 2005). Local people may find it difficult to separate the pollution issues from other material concerns embedded in the surroundings (Burningham and Thrush, 2004).

The literature shows that local residents living in an area affected by pollution tend to be reluctant to recognise pollution in their own neighbourhood (Phillimore and Moffatt, 2004). In some cases identifying the pollution caused by a local industry as a serious risk may pose more threats than it

resolves (Burningham and Thrush, 2004). For instance, an interviewee that owns a farm in one of the sites explained that agriculture on the ashes did not pose any environmental risk. Instead he was convinced that only "*lazy people*" did not want to cultivate the sites. In contrast, those who oppose cultivation argue that the consumption of crops from the disposal sites endangers the whole community, and it is "*what kills people over here* [the local community]", as one local resident from Bukinje explained.

When collective action and mitigation strategies are limited other individual strategies may arise. For instance, a local representative in Tuzla explained that emigration of young generations in search of "better" places to live is a common trend in the area. Among the locals a frequent refrain is that the young ones are gone; they went away to the cities [or even to foreign countries] in search of a better life. Individual coping strategies may result in the fragmentation of the polluted community and the stigmatisation of those who are more affected by the pollution (McGee, 1999).

To summarise the fourth perspective, people and landscape interact. While dwelling in landscapes, people develop risk management strategies to cope with pollution. These strategies are likely to have influences back upon the pollution landscape. The natural elements of landscape, its meanings and its autonomy all seem to be embedded in the actions through which local people live their everyday lives.

DISCUSSION

Understanding landscapes as artefacts to fulfil human needs may be a useful view when landscapes need to be managed under scarcity of resources. Establishing needs enables us to establish clear objectives and priorities, which can be translated, into policy and management actions. However attending exclusively to environmental and physical variables denies the existence of a landscape strongly influenced by sociological variables.

The case study in Tuzla shows the importance of landscape meanings, which are continually negotiated through social processes. Attempts by powerful actors to appropriate landscapes may result in conflicts with those engaging with the land in different ways (Bender, 1993; 246). Landscape modifications may challenge people's interactions with their environment and their self-definition (Greider and Garkovich,

1994). Therefore the symbolic dimensions of landscape set limits to its management: they help to define what is acceptable within a society.

Because landscapes are constructed through human experience it is important to include the people living on it and the variety of their human experience in landscape management. This strategy may help to avoid possible conflicts arising from the confrontation of different perspectives and meanings of landscape. Other additional benefits may be creating trust between different stakeholders or contributing to a sense of collective identity and ownership of the landscape.

Some landscape ecologists have acknowledged the importance of incorporating considerations of the relationship between society and landscapes into landscape planning. Landscape management needs to incorporate humans because they are "*integral components of the ecosystem*" (Botequilha and Ahern, 2002; 67). Human societies are also important drivers of change in landscapes (Field *et al*., 2003). Other authors recognise the importance of incorporating a "*proper participation process*" in order to incorporate different accounts of the landscape in the management process (Kangas *et al*., 2005; 612).

Landscape management should also consider that landscapes have their own agency influencing both material and symbolic dimensions of landscapes. The way in which landscapes react to human induced change is highly unpredictable. The perception of the risk created by an environmental change is a manifestation of the landscape agency over the meanings that humans attach to landscapes.

Risk dynamics mirror the relationship between society and landscapes in the face of an environmental change such as pollution. When landscapes are regarded as material entities, risk is the possibility of compromising the capacity of the landscape to fulfil societal needs. When landscapes are understood as symbolic constructions, risk is the construction that can turn a landscape from a benign entity to a hazardous one. The meaning and experience of landscapes changes depending on how the risk of pollution is interpreted. But risk perceptions "*have a reality of their own*" (Renn, 2004). Its very construction makes the risk closer and more 'real'.

A pollution landscape may be explained in several ways, from analysing the pollutants to understanding how people perceive the pollution and its causes. Some of these perspectives are frequently combined in additive fashion. However, in the example of Tuzla a more complete picture of

the landscape emerges from understanding people's actions on that landscape, beyond its natural and symbolic components.

CONCLUSION

The example of coal ash pollution in Tuzla has allowed the exploration of the relationship between societies and landscapes in the case of a pollution landscape. A pollution landscape is not only one where some of its elements are polluted. A pollution landscape requires also the social construction of the landscape as a malevolent environment which conditions the lives of those dwelling on it. In a pollution landscape, atypical and unfamiliar phenomena are perceived as symptoms of the hazardous nature of that landscape.

The four perspectives applied in this paper give us useful insights about our understanding of the landscape, but each of them presents some limitations. Understanding landscapes as providers of human needs fails to explain some of the main characteristics of the pollution landscape, such as its symbolic nature, but it may provide concrete action points to guarantee that those needs are fulfilled. Studying the meanings that humans attach to landscapes fails to acknowledge the influence of natural processes on human life, but it identifies the social limitations to landscape management and the possible points of conflict between the different actors. Studying the agency of pollution landscapes give us a sophisticated view of how pollution landscape may influence human action, and highlights the importance of the unexpected in pollution landscapes. Finally, understanding landscapes as places of dwelling helps to understand the actions that humans develop while living in landscapes. Although this perspective reflects better the dynamic nature of landscapes and its interaction with societies, it does not provide clear answers as to how to preserve landscape functions, how to prevent conflicts between different actors or how to cope with unexpected responses given by pollution landscapes.

Each perspective gives responses to different questions. Hence, the perspectives are complementary rather than opposite. However, from the paper arises the idea that the last perspective, understanding landscapes as dwelling places, may have a more holistic and dynamic character. This view argues that a landscape is an interactive complex of natural and symbolic components that are mutually influenced by both society and landscapes. Both society and landscapes shape each other, reformulating meanings,

changing physical realities and modifying the factors that influence society perceptions. This endless circle of mutual transformation merges societies and landscapes in a network of actions, dissolving their frontiers into a "hybrid" system.

Rather than analysing the independent components of landscapes, this perspective suggests that landscapes can better be represented by studying the actions developed on and by them. For instance, in the case of the pollution landscape in Tuzla, a picture of the landscape emerges by understanding how local inhabitants develop risk management strategies to cope with environmental threats. The landscape of Tuzla is therefore better understood by studying the actions of all the actors on that landscape and those performed by the landscape itself.

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FIGURES

Figure 1: Different perspectives on the relationship between landscapes and society and its components

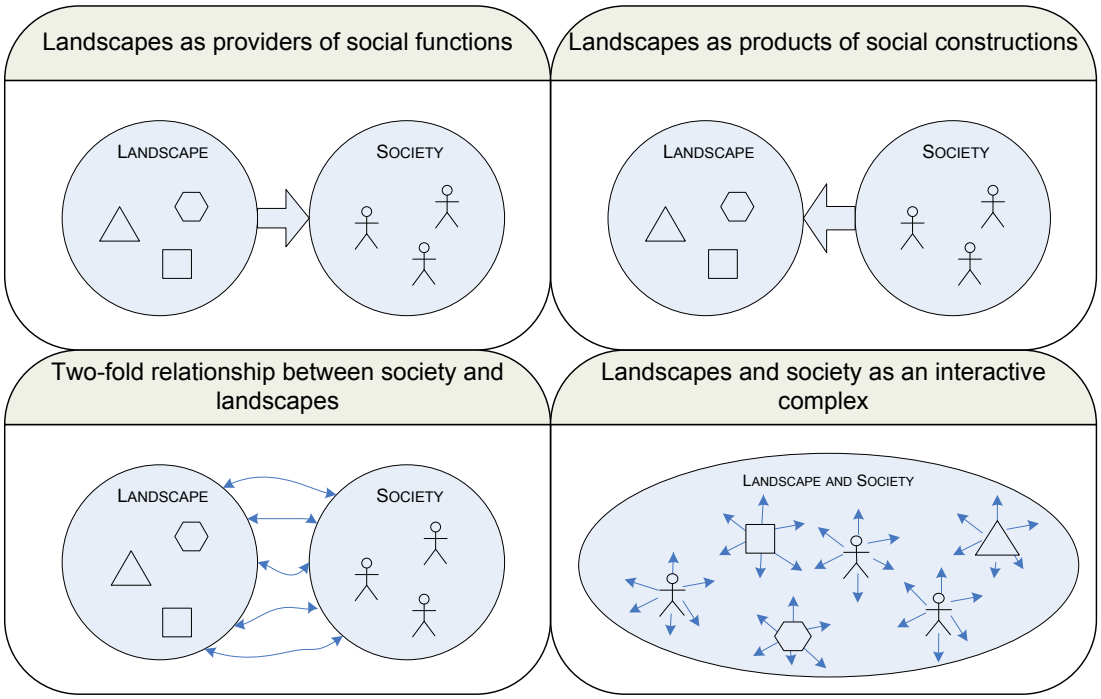

Figure 2: Map of the disposal sites, TEP and inhabited areas.

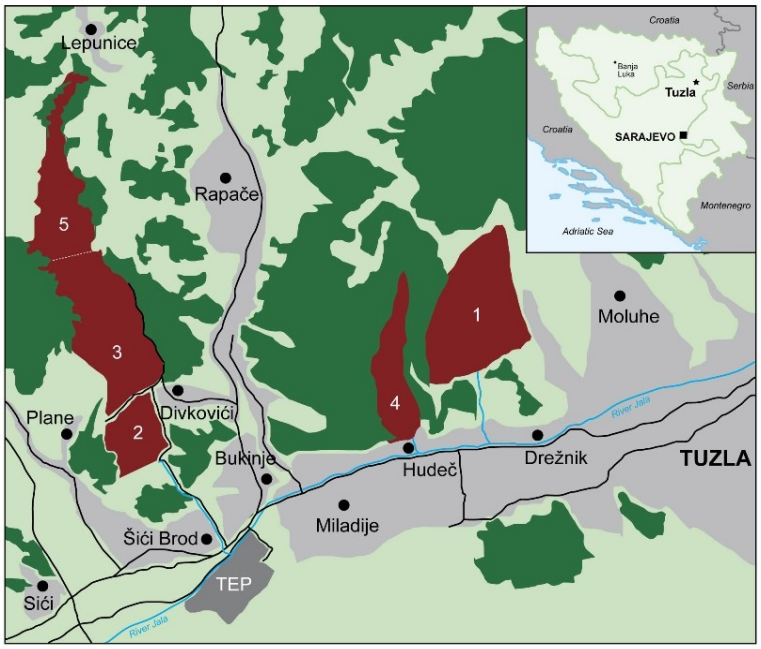

Figure 3: TEP has a powerful influence on the perception of the landscape

Figure 4: Some private residents are literally on the border of the disposal sites.

NOTES

1. European Landscape Convention, CETS No 176. Entry into force: 10th March, 2004. The European Landscape Convention has been ratified by 25 members of the Council of Europe; Bosnia and Herzegovina has neither signed it, nor ratified it.

2. NUD*IST Vivo (NVivo); qualitative research software develop by QSR International Pty Ltd.

REFERENCES

Adriano, D. C. and J. T. Weber (2001). "Influence of Fly Ash on soil physical properties and turfgrass establishment." **Journal of Environmental Quality 30**: 596-601.

Alloway, B. J. and D. C. Ayres (1993). **Chemical Principles of Environmental Pollution**. Glasgow, Blackie Academic & Professional (Chapman & Hall).

Beck, U. (1992). **Risk Society: Towards a New Modernity**. London; Newbury Park, CA, Sage Publications.

Bender, B. (1993). Stonehenge- Contested Landscapes (medieval to present day). **Landscape: politics and perspectives**. in Bender, B. (ed). Oxford, Providence, Berg publishers**:** 245-280.

Botequilha Leitao, A. and J. Ahern (2002). Applying landscape ecological concepts and metrics in sustainable landscape planning. **Landscape and Urban Planning** 59(2): 65-93.

Brkić, H. and N. Barčić (*undated*). **Ubi nas "Razvoj"**. Tuzla, MZ Šićki Brod, MZ Bukinje, DJL "Wisca" Tuzla.

BTUC (2005). **RECOAL-Deliverable 8. Risk Assessment. First Draft**. Cottbus, Branderburgische Universitat Cottbus.

Burningham, K. and D. Thrush (2004). Pollution concerns in context: a comparison of local perceptions of the risks associated with living close to a road and a chemical factory. **Journal Of Risk Research** 7(2): 213-232.

Cheng, A. S., L. E. Kruger and S.E. Daniels (2003). "Place" as an integrating concept in natural resource politics: Propositions for a social science research agenda. **Society & Natural Resources** 16(2): 87-104.

Clancy, T. and W. van Enkelen (2005). **A guided journey through central and north Bosnia**. Sarajevo, Buybook.

Cosgrove, D. (1998 [1984]). **Social formation and symbolic landscape- with a new introduction.** Madison, University of Wisconsin Press.

Darvill, T. (1999). The historic environment, historic landscapes, and space-time-action models in landscape archaeology. in P. Ucko and R. Layton (eds) **The archaeology and anthropology of landscapes.** London, NY, Routledge**:** 104-118.

1 Davis, J. S. (2005). "Is it really safe? That's what we want to know": Science, stories, and dangerous
2 places. **The Professional Geographer** 57(2): 213-221.
3 Dudley, J. P., J. R. Ginsberg, A.J. Plumptree, J.A. Hart and L.C. Campost (2002). Effects of war and
4 civil strife on wildlife and wildlife habitats. **Conservation Biology** 16(2): 319-329.
5 Edelstein, M. R. (2004). **Contaminated communities: coping with residential toxic exposure.**
6 Cambridge, Westview press.
7 Field, D. R., P. R. Voss, T.K. Kuczenski, R.B. Hammes and V.C. Radeloff (2003). Reaffirming social
8 landscape analysis in landscape ecology: A conceptual framework. **Society & Natural**
9 **Resources** 16(4): 349-361.
10 Gallagher, R. and T. Appenzeller (1999). Introduction to special issue: beyond reductionism. **Science**
11 284 (5411): 79.
12 Giddens, A. (1999). Risk and Responsibility. **Modern Law Review** 62(1): 1-10.
13 Greider, T. and L. Garkovich (1994). Landscapes - the social construction of nature and the
14 environment. **Rural Sociology** 59(1): 1-24.
15 Harner, J. (2001). Place identity and copper mining in Sonora, Mexico. **Annals Of The Association of**
16 **American Geographers** 91(4): 660-680.
17 Ingold, T. (2000). The temporality of Landscape. in T. Ingold, **The perception of the environment:**
18 **essays in livelihood, dwelling and skill**. London, NY, Routledge**:** 189-208.
19 Kangas, J., R. Store and A. Kangas (2005). Socioecological landscape planning approach and
20 multicriteria acceptability analysis in multiple-purpose forest management. **Forest Policy and**
21 **Economics** 7(4): 603-614.
22 Lahiri, N. and U. Singh (1999). In the shadow of New Delhi: understanding the landscape through
23 village eyes. in P. Ucko and R. Layton. (eds)**The archaeology and anthropology of**
24 **landscape**. London, NY, Routledge**:** 175-188.
25 Leibowitz, S. G., Loehle, C., Li, B., Preston, E. M. (2000). Modeling landscape functions and effects: a
26 network approach. **Ecological Modelling** 132(1-2): 77-94.
27 Macnaghten, P. and J. Urry (1998). **Contested Natures.** London, Sage.
28 Massey, D. (1994). **Space, place and gender**. Cambridge, Polity.
29 McGee, T. K. (1999). Private responses and individual action: community responses to chronic
30 environmental lead contamination. **Environment and Behavior** 31(1): 66-83.

Mercer, D. (2002). Future-histories of Hanford: the material and semiotic production of a landscape. **Cultural Geographies** 9(1): 35-67.

Mitchell, W. J. T. (2002). **Landscape and Power.** Chicago, London, The University of Chicago Press.

Murdoch, J. (2001). Ecologising sociology: Actor-network theory, co-construction and the problem of human exemptionalism. **Sociology** 35(1): 111-133.

Petrzelka, P. (2004). The new landform's here! the new landform's here! We're somebody now! The role of discursive practices on place identity. **Rural Sociology** 69(3): 386-404.

Phillimore, P. and S. Moffatt (2004). 'If we have the wrong perceptions of our area, we cannot be surprised if others do as well.' Representing risk in Teesside's environmental politics. **Journal Of Risk Research** 7(2): 171-184.

Rackham, O. (1990). **Landscape and the Conservation of Meaning.** Reflection Riding Memorial Lecture., Society of Arts, BSA Journal.

Relph, E. (1985). Geographical experiences and being-in-the-world: the phenomenological origins of geography. **Dwelling, Place and Environment**. D. Seamon and R. Mugerauer. NY, Columbia University**:** 15-32.

Renn, O. (2004). Perception of risks. **Toxicology Letters** 149(1-3): 405-413.

Sapountzaki, K. and C. Chalkias (2005). Coping with chronic and extreme risks in contemporary Athens: confrontation or resilience? **Sustainable Development** 13 (2): 115-128.

Stedman, R. C. (2003). Is it really just a social construction? The contribution of the physical environment to sense of place. **Society & Natural Resources** 16(8): 671-685.

Thomas, J. (1993). The Politics of Vision and the Archaeologies of Landscape. in B. Bender.(ed) **Landscapes: politics and perspectives**. Providence, Oxford, Berg Publishers**:** 19-48.

Tuan, Y. F. (1977). **Space and Place: the perspective of experience**. Minneapolis, University of Minesota Press.

Wynne, B. (1996). May the sheep safely graze? A reflexive view of the expert-lay knowledge divide. in S. Lash, B. Szerszynski and B. Wynne (eds) **Risk, Environment and Modernity: Towards a New Ecology**. London; Thousand Oaks, CA, Sage.